

Missouri valley, 73.9; Northern Pacific coast region, 91.7; Central Pacific coast region, 94.7; Southern Pacific coast region, 100.0. There were 56 omissions to predict (40 being due to the absence of reports from the Pacific coast), out of 3,813, or 1.44 per cent. Of the 3,757 predictions that have been made, 192, or 5.11 per cent. are considered to have entirely failed; 157, or 4.18 per cent. were one-fourth verified; 374, or 9.96 per cent. were one-half verified; 363, or 9.66 per cent. were three-fourths verified; 2,671, or 71.09 per cent. were fully verified, so far as can be ascertained from the tri-daily reports.

*Cautionary Signals.*—231 Cautionary signals were displayed during the month of October, 1881, of which 178, or 77.05 per cent., were fully justified by winds of twenty-five miles per hour, or over, at, or within, a radius of 100 miles of the station. Thirty-one Off-shore signals were displayed, of which 22, or 70.97 per cent., were fully justified; 28 or 90.32 per cent., were justified as to direction; 22, or 70.97 per cent., were justified as to velocity, and 3, or 9.67 per cent., completely failed. Seven Off-shore signals, were changed to Cautionary. 262 signals, of all kinds, were displayed, of which 200, or 76.33 per cent., were fully justified. The above does not include signals ordered at display stations, where the velocity is only estimated. 74 winds, of 25 miles, or over, were reported, for which no signals were ordered. 51 signals were ordered late.

## NAVIGATION.

*Stage of Water in Rivers.*—In the table on the right-hand side of chart No. III are given the highest and lowest stages of water, as observed at Signal Service stations during the month of October, 1881. The Red, Arkansas and Missouri rivers have remained at a moderate stage throughout the month, except that the latter at Yankton was extremely low. The Ohio, Cumberland, Tennessee, Monongahela, Savannah and Sacramento rivers were extremely low, particularly the first and last named. In the Mississippi a marked contrast with other large rivers appears; a very heavy rise began the second week of the month, resulting in a flood about the fourth week, which assumed very serious proportions, causing an immense loss of property between St. Paul and St. Louis.

*Floods.*—*Illinois:* Quincy, 20th, river 18 feet above low water mark and rising rapidly; water 8 inches higher than the great flood of last spring; all railroads submerged and travel suspended; on the Missouri side of the river, bottoms flooded back to the bluffs; river below city fully nine miles wide. 28th, river highest since 1851; nothing can now prevent a complete inundation. Farms for a distance of 25 miles along the bottoms on the Missouri side of the river were abandoned, perhaps never to be reclaimed, everything perishable has been destroyed; no such terrible destruction and destitution ever before experienced in the history of this section. Springfield, 5th, rain-fall for past five days measured 9.96 inches, heaviest ever known; rivers converted into raging torrents and small streams into large rivers; very serious washouts on railroads, travel generally suspended. Warsaw, 22d, 35,000 acres of land submerged by the breaks in the Warsaw and Indian Grove levees; the damage to railroads, live stock and farming property make this flood the most disastrous that has ever occurred in this section; 29th, the damage to property along the Mississippi between Keokuk and Louisiana, Mo., is estimated at \$2,930,000; several days will elapse before business can be resumed at the river towns. Carlinville, 14th, hay and corn rotting in the fields; hundreds of acres under water; all streams overflowed; most disastrous flood for years. Galena, 21st, one of the principal thoroughfares of the city under water from one end to the other; City Hall and Market House, Custom House and Post Office surrounded; all railroad tracks under water and travel generally suspended. Rockport, 22d, although situated four miles from the Mississippi, a serious flood is imminent; people fleeing to places of safety; roads leading outward from the bottoms crowded with teams hurrying away with goods; hundreds of animals driven away from the flooded region. Moline, 12th, work suspended in mills; 27th, corn fields in vicinity all under water and crop will prove a total loss. Rock Island, 14th, many cellars and streets flooded in upper part of town; 17th, lower part of town flooded; families moving to escape danger; 21st, the entire lower portion of the town flooded. *Iowa:* Burlington, 24th, river reached the high-water mark of 1880; width said to be seven miles; hay stacked along the low-lands on the Illinois side is a total loss. 27th, river seven inches above the flood-tide of 1880. 31st, river continued to rise. Davenport, 12th, water so high at mouth of Rock river that nearly the whole of "Big Island" was submerged; corn fields in vicinity flooded and operations suspended in mills; trains stopped on C. M. and St. P. R. R. on account of high water; much debris, fences and remains of wood yards passing. 15th, river continued to rise; all trains for Rock Island stopped; men are kept watching and strengthening the dyke which threatens to give way. 19th, river rose two inches; street car tracks in some localities under water. 20th, river continued to rise; all of the wood side-walks afloat; streets impassable. 21st, river rising; the Davenport division of the C. M. and St. P. R. R. Co. moved their engines out of the round-house and stored them in the round-house of the C. R. I. and P. R. R. Co., for safety from damage by flood; water stopped the Holly engine at the water works. 22d, river reached the sidewalk on First avenue, and stretched from there to Iowa street in an unbroken waste of water; cars on the Peoria and Rock Island R. R. stood out 2.0 feet in the river, all tracks submerged, cellars,

warehouses, basements and stores badly flooded, causing great loss; work in all industrial establishments has been suspended. 23d, river rising; first floors of all buildings from Iowa to Rock Island streets flooded. 24th, river rising slowly. 27th, river stationary; the steamer "Jennie Gilchrist," after passing through the draw of the Government bridge, was swung around by the fierce current and thrown violently against the latter causing a total wreck. 28th, river commenced falling slowly. Dubuque, 8th, work suspended in mills on account of high water; flats overflowed; island covered; cellars filled; over 200 men thrown out of employment. 10th, river two miles wide; thirty houses on flats submerged to second stories; a number of families living on the low lands of East Dubuque, were compelled to abandon their homes; mills and factories compelled to suspend operations. 11th, river rising slowly. 21st, river 21 feet above low water mark, and but 18 inches below the highest water ever known; railroad tracks and warehouses flooded; reports from interior of State show that in over one-fourth of northern Iowa the hay crop is entirely ruined; entire farms for scores of miles completely under water; the flax crop is ruined. Keokuk, 2d, considerable damage to the K. and St. L. R. R., seven miles below station; river rising rapidly. 4th, bridges carried away on the K. and St. L. R. R. 9th, river rising slowly. 13th, river reached danger-line this morning; railroad tracks under water. 14th, several mills and factories suspended business. 17th, river still rising rapidly; Des Moines river very high, breaking the Egyptian levee near Buena Vista. 29th, low lands for miles entirely under water; canal closed and steamers pass over the rapids; from the large bridge to Hamilton one unbroken sheet of water covered with debris of every nature; water within 15 inches of the high water mark of 1851. Clayton, 11th, river rose over 6 inches in past 24 hours; largest rise ever experienced for this season of the year; considerable loss to property. Guttenburg, 30th, no farm work can be done on account of wet weather; during a period of 30 years the river at this point has not been as high at this season of the year, and never during that time has the damage to the corn crop been so great; large quantities of hay have been floated off by the high water. Muscatine, 28th, river reached its highest point (17 ft., 8 in. above low-water mark) it being the highest ever known, and one-half inch higher than the June rise of 1880. Clinton, 26th, river rose 19 ft. 10 in., which was only 11 in. below extreme high water mark; highest water ever known at this season of the year.

**Kansas:** Yates Centre, 5th, Cedar Creek rose 8 ft., the largest rise for a number of years; 9th, rose 3 ft. in 20 minutes; 17th, rose 9 ft. in a few hours; stock, corn and fences were swept away. Month remarkable for unusually heavy and frequent rains, it being the wettest October for many years.

**Minnesota:** New Ulm, 14th, river overflowed and rising rapidly. Sleepy Eye, 14th, all streams flooded; much damage in surrounding country. Le Sueur, 14th, considerable loss of hay along the bottoms; earth filled with water, rendering almost impossible to travel any distance, even on horseback. St. Peter, 14th, river rising rapidly; corn fields under water; loss of hay serious. Fairbault, 14th, Straight river overflowed, carrying away dams and bridges. Shakopee, 14th, all railroad travel suspended; great quantities of hay washed away; river still rising. Kasota, 7th, river overflowed and the surrounding country flooded; many farm houses rendered uninhabitable by the water which surrounds them. Mankato, 7th, Minnesota river overflowed for miles, great damage to hay and buildings. St. Paul, 5th, some of the low lands on both sides of the river near the town partially flooded; large quantities of cord-wood have been carried away. 6th, river rising slowly, causing much alarm to the residents of West St. Paul. 7th, river rising.

**Missouri:** Hannibal, 28th, the break in the Sny Levee 300 yards north of the Hannibal bridge has a width of 200 feet; everything carried away by the rushing torrent; all reclaimed land back of Lewes under water; considerable loss of stock by drowning; aggregate loss from overflow about \$500,000. Alexandria, 26th, river one foot above the flood mark of last spring and within 2 feet and four inches of the great rise of 1851; city almost entirely inundated; people living in the upper stories of their dwellings or leaving the city in skiffs. Clarksville, 21st, river seven inches above the high water mark of last spring; all people living in the bottoms have been driven from their homes; great suffering from loss of property and the necessities of life. The following general summary of damage sustained by the country along the central portion of the Mississippi river although, perhaps, not more than approximating the truth will be found of interest: Warsaw Drainage district, \$600,000; Indian Grave district, \$750,000; Sny Island district, \$1,000,000; Quincy Bay and City, \$3,000; Alexandria and vicinity, \$250,000; Keokuk and St. Louis R. R., \$100,000; other railroads, \$60,000; open lands north of Sny Levee, \$150,000; total, \$2,913,000.

**New Mexico:** Las Vegas, 6th, great damage on the Atchinson, Topeka and Santa Fe R. R.; all traffic south of this point suspended; in the Rio Grande and Gallister valleys numerous heavy washouts, and in many places road-bed covered with great heaps of sand.

**New York:** Buffalo, 2d, one of the heaviest rain-falls that ever occurred in this vicinity; sewers broken, streets badly washed and many buildings flooded.

**North Carolina:** Highlands, 27th to 30th, rain-fall 8.57 inches, accompanied by the severest freshet experienced for many years.

**Texas:** Grierson Springs, owing to the heavy rains of the latter part of month, the canyon in which the station is situated was flooded for several days, and buildings were in danger of being swept away. Brackettville, 1st, streets flooded; one man was drowned, and many persons narrowly escaped similar fate. Reliable estimates of damage done are as follows: to stores and

private dwellings in Brackettville, \$7,000; damage sustained by ranchmen in surrounding country, \$16,000; two men alone lost 2,326 head of sheep; damage to grading on Mexican Pacific Railroad in Kinney county, \$50,000; total, \$73,000. In the Pinto and Los Mares rivers water rose from 3 to 5 feet, doing an immense amount of damage. *Wisconsin*: Stillwater, 4th, river 13 feet and 9 inches above low-water mark; mills shut down; bridges and dams carried away. Warsaw, 4th, most remarkable flood on record; highest water ever known; 8,000,000 feet of logs swept away; roads badly washed, and bridges and lumber-piles carried away; total loss in Marathon county alone, over \$150,000. Stevens Point, 14th, Black river rose 8 feet in past twenty-four hours; surrounding country flooded; heavy floods reported along Wisconsin river. Galesville, 12th, highest water for many years; all hay along the streams ruined. 14th, roads impassable and all kinds of business seriously embarrassed. Eau Claire, 12th, Chippewa river  $7\frac{1}{2}$  feet above low water mark. 13th, river 14 feet above low water mark and rising at the rate of  $2\frac{1}{2}$  inches per hour; Eau Claire river highest ever known; several buildings undermined and washed out in the river; 40,000,000 feet of logs carried out. Oskosh, 7th, exceedingly heavy rains; serious washouts on the Chicago and Northwestern R. R., and on the Milwaukee, Lake Shore and Northwestern R. R.; communication generally suspended; country round about badly flooded. Merrill, 4th, river higher than ever known before; all mills shut down; several railroad bridges carried away. Prairie du Chien, 11th, river rising rapidly; all travel suspended on the C. M. and St. Paul R. R., and five miles of track washed out. Waupaca, 14th, vast amount of damage by heavy rains; potatoes lying in the ground by the thousands of bushels, it being too wet to remove them; corn still unhusked and clover seed too wet to thresh. Fond du Lac, 15th, streets impassable and cellars and basements flooded; heavy losses in the country. 18th, roads again flooded; in places, stacks of unthreshed grain rotting. Horicon, 15th, thousands of acres overflowed and many highway bridges swept away. Packwaukee, 15th, all bridges between this point and Portage washed away. Fox Lake, 14th, potato crop rotting in the mud; cut hay rotting and floating away; unthreshed grain spoiling and corn sprouting in the fields; impossible to drive over fields, owing to the very soft condition of the soil. Chippewa Falls, 13th, river highest for many years, bridges on all the small streams carried away; roads impassable, trains delayed and all kinds of work at a stand-still. Edson, 14th, entire town flooded, loss of property will reach into the thousands. Milwaukee, 18th, dam in Milwaukee river swept away. La Crosse, 2d, the recent heavy rains have caused the tributaries to the Mississippi in this vicinity to rise to such an extent as to cause alarm. The Black river valley flooded and a great deal of property destroyed; bridges, dams, etc., have been swept away and much timber lost; farms inundated on both sides of the Mississippi and Black rivers. 13th, Mississippi river stationary at 12 feet one inch above low water mark; Black river highest ever known for the season; Wisconsin river experienced the heaviest rise ever known for this season of the year and serious damage was caused. 16th, much damage done to stacked wheat and hay; corn in great quantities was floated away and large fields of potatoes in some places entirely under water.

*Drought.—Connecticut*: New London, 29th, ground parched as if a forest fire had swept over it; streams that have never been known to fail are now reduced to a mere rivulet or dried up altogether; no rain has fallen for many weeks; farmers suffering great distress through the drying up of wells and cisterns. Southington, up to the 30th, drought continued with unabated severity; although rain fell on 13 days the quantities were so small as to be scarcely noticeable; a natural pond in the vicinity has remained dry for more than four weeks, a condition which has not occurred before within the past 20 years. *Maryland*: Fallston, 30th, springs and wells very low; farmers driving stock long distances for water, and in some localities are hauling water for domestic purposes; pasturage very poor. Sandy Springs, very dry until 24th; wheat crop seriously injured. *New Jersey*: Patterson, 22d, most serious drought ever experienced; no water has passed over Passaic Falls for the past two months, and for a longer period the mills on the race have been but in partial operation; this is the fourth month of the continued drought; during the months of July, August, September and October, the total rainfall was only 7.83 inches, a deficiency of 8.28, or more than 100 per cent. when compared with the average for those months for the past half century. Since 1830, only one year (1854) has a smaller rain record for those months, than the present year. There is no record of the Passaic river being as low as during the prevalence of this drought. Moorestown, the abundant rains of the 30th and 31st, close a period of the most terrible drought experienced during the past 18 years. *Pennsylvania*: Dyberry, drought continued unabated until last of month. Chambersburg, 28th, dry weather still continues. Milton, 29th, drought still severe; many wells exhausted, some of which were never known to have failed before. Wellsboro, 30th, wells, springs and streams still very low. *Tennessee*: Ashwood, 30th, the protracted drought of summer continued until the middle of the month. *New York*: Jefferson Co., 15th, drought still unabated at Woodville; people hauling water for drinking and culinary purposes. *Rhode Island*: Providence, 15th, the severe drought of the past two months continues unabated; mill streams are so low that only steam power can be used; many reservoirs are exhausted.

*Water Spouts*.—Off the coast of Cheboygan Co., Mich., and near Mackinac straits, a large and well defined water spout was observed on the 1st by passengers on the steamer *Flora*; the phe-

nomenon lasted 30 minutes. Barnegat, N. J., 18th, 4 miles below station, moving southeastward across the bay.

*High Tides.*—Indianola, 1st, 8th; Norfolk, 5th; New London, 26th; New Haven, 29th.

## TEMPERATURE OF WATER.

*The temperature of water*, as observed in rivers and harbors at Signal Service stations, with the average depth at which observations were taken, is given in the table on the left-hand side of chart No. III. Owing to the breakage of instrument, observations at Charleston, S. C., wanting from the 1st to 7th.

## ATMOSPHERIC ELECTRICITY.

*Thunder Storms.*—In the various districts they were reported as follows: New England, 3d, 17th, 18th; Middle Atlantic states, 1st, 17th, 18th, 30th, 31st; South Atlantic states, 17th, 18th, 19th, 30th, 31st; East Gulf states, 1st, 16th, 18th, 19th, 23d, 29th, 30th; West Gulf states, 4th, 11th, 15th, 17th, 23d, 26th, 27th, 29th; Rio Grande valley, 22d, 23d, 26th; Ohio valley and Tennessee, 2d, 3d, 4th, 8th, 9th, 13th, 15th to 19th, 28th to 30th; Lower Lake region, 2d, 8th, 15th, 17th, 27th; Upper Lake region, 1st, 6th to 8th, 12th, 14th, 15th, 17th, 28th, 29th; extreme Northwest, 10th, 11th; Upper Mississippi valley, 3d, 4th, 7th, 8th, 11th, 13th to 16th, 19th, 21st, 27th, 28th; Missouri valley, 1st to 4th, 8th to 18th, 21st to 23d, 27th to 30th; Northern Slope, 10th, 16th; Middle Slope, 8th, 11th, 12th, 14th to 16th, 21st, 22d, 26th, 27th; Southern Slope, 3d, 12th, 13th, 16th to 18th, 22d, 26th; Southern Plateau, 3d to 8th, 12th to 15th, 18th, 21st, 23d, 24th; Middle Plateau, 10th, 25th; Northern Plateau, 6th.

*Auroras.*—The most general display was that of the night of the 16th and 17th, which was observed from Sydney, N. S., westward to Ft. Sisseton, Dak., and as far south as Freehold, N. J., 17 intervening stations reporting. The display was not a very remarkable one, many of the features usually observed being absent. The display of the 18th was exclusively observed in the Lake region being reported by the following stations: Marquette, 18th, from 10.10 to 11.15 p. m.; Mission House, Wis., 18th, from 9 to 11 p. m., faintly illumined arch, with dark cloud underneath; Alpena, Mich., 18th, 9.10 p. m., diffuse light without streamers; Toronto, 18th. Other displays were reported as follows: Charlottetown, P. E. I., 20th, 21st, 27th. Fredericton, N. B., 7th, 19th, 27th. Dexter, Me., 19th, faint. Mt. Washington, 19th, from 11.22 p. m., to early morning of 20th, faint light. Burlington, Vt., 19th, from 11 to 11.45 p. m., faint; 20th, 11 to 11.30 p. m., faint; 26th, 11 to 11.40 p. m., faint; 27th, 11 to 11.45 p. m. A noteworthy feature of the display of the 27th was its nearness to the horizon; the dark segment was about 2° above the horizon; dancers and streamers were observed, the latter shooting up to a height of 25°; the general color was a faint yellowish light, but that of the dancers was a pale green. Woodstock, Vt., 19th. South Lee, Mass., 29th, p. m. Eastport, Me., 27th, 10 p. m. to midnight; extended from NW. to NE. and to an altitude of 15°; at 11 p. m. numerous beams appeared, all radiating from the same magnetic point, resembling rays of light from the sun, such as are sometimes seen after sunset; their color was a bright yellow. Newport, R. I., 3d, 7 to 9 p. m. Toronto, 20th, 26th. Alpena, 20th, 8.40 p. m., faint yellow light, with an occasional streamer; ended at 1 a. m. of 21st. Marquette, 20th, 9.50 p. m.; very brilliant at 10.40 p. m., when beams began to shoot up to a height of 30°; the entire northern heavens was illuminated; disappeared at 11.40 p. m. Escanaba, 8th, 9.15 to 9.35 p. m., a few streamers pointing toward zenith; 20th, 10.05 to 11.30 p. m., consisting of beams of pale yellow, having a wavy motion from E. to W. Ft. Snelling, Minn., 31st, 5 a. m. St. Vincent, Minn., 19th, 9 p. m., low down in the north; was bright, sending up many streamers until midnight; 20th, from 8 to 10 p. m., consisting of an arch of about 15° in height, with dark segment; a few streamers and folds; 27th, from 8 to 10 p. m., about 20° in height; was partially obscured. Riley, Ill., 21st, a mere northern twilight; altitude about 12°. Keokuk, 12th, aurora probable; clouds unusually bright in the northern sky from an altitude of 8° to zenith; earth currents interrupted telegraphic communication. New Corydon, Ind., 19th, 2 a. m., strong auroral light; 22d, 2 a. m., strong auroral light.

*Atmospheric Electricity Interfering with Telegraphic Communication.*—Silver City, N. M., 3d; Stockton, Tex., 12th, 16th, 17th.

*Zodiacal Light.*—Monticello, Ia., 25th; Des Moines, Ia., 4th; Cambridge, Mass., suspected, 11th, 14th, 26th; Nashville, Tenn., 1st, 2nd, 3rd. New Corydon, Ind., 20th to 23d, 25th to 27th.

## OPTICAL PHENOMENA.

*Lunar halos* have been observed in the various districts on the following dates: New England, 3d, 5th, 6th, 7th, 28th, 30th, 31st; Middle Atlantic states, 2d, 3d, 6th, 7th, 9th, 12th, 28th; South Atlantic states, 2d, 6th, 7th, 9th, 29th, 30th; East Gulf states, 2d, 7th, 8th; West Gulf states, 2d, 3d, 4th, 10th, 28th to 31st; Rio Grande valley, 3d, 5th, 6th, 27th; Ohio valley and Tennessee, 2d, 3d, 7th, 8th, 9th, 11th, 17th, 22d, 27th, 29th, 30th; Lower Lake region, 6th, 7th, 11th, 12th, 28th, 30th, 31st; Upper Lake region, 5th to 11th, 30th, 31st; extreme Northwest, 2d, 9th; Upper Mississippi valley, 2d, 3d, 6th, 8th, 9th, 29th to 31st; Missouri valley, 2d, 3d, 4th, 6th, 12th, 29th, 31st; Northern Slope, 6th, 15th, 28th, 30th; Middle Slope, 1st, 6th, 8th; Southern Plateau, 2d, 27th to 30th; Middle Plateau, 6th, 28th; Northern Plateau, 7th, 8th, 31st; North Pacific region, 14th; Middle Pacific region, 11th, 18th, 28th; South Pacific region, 2d.